Feedstock for biorefineries and advancement of value-added products from biomass

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Outline The global expansion of cropland at the expense of and by shrinking the forest area is obviously incompatible with future projects of biorefineries based on ligno-cellulosic feedstock from wood in which case the preference of fast-growing species would inevitably become perilous to biodiversity. For that reason efforts should be made to study the ways and energy-efficient technologies converting other abundant products of photosynthesis – preferably by-products of forestry and agriculture, into chemicals and fuels.

Keywords: wood, hemp, steam explosion, composites, heat insulation, electro-nano-spinning.

1. Introduction

Recently targets of bio-fibres modification include new composites – particularly, smart materials on nano- and micro-size level without using any synthetic binders. Nano-fibrous materials from cellulose prepared by electro-spinning techniques as well as heat insulation materials from hemp shives are excellent examples of advanced material development.

2. Experiment

Steam explosion (SE), ball milling and ultrasound pre-treatment have been used for electro-spinning of PVA and natural fibres. Self-binding composites and heat insulation materials have been characterized by chemical, physical and mechanical methods.

3. Results and discussion

The industry of wood composite materials depends on fossils for synthetic adhesives. Alternative solutions are provided by SE pre-treatment liberating adhesive substances activated during successive hot-pressing. The studies confirm a potential for utilising low-quality wood and by-products to make value-added composites competing with commercial artefacts.

Recently modification of poly(vinyl alcohol) (PVA) nano-fibres by microcrystalline cellulose from wood, hemp fibres and shives prepared by SE, ball milling and ultrasound processing has proved successful for producing PVA/cellulose nano-fibre composites by electro-spinning technologies.

Renewable materials for thermal insulation meet one of the most important requirements for sustainability and measures reducing the energy consumed for heating the buildings An excellent heat and noise insulating material is obtained by mild SE pre-treatment of hemp shives. In addition, the use of plant biomass insulating materials in constructions makes the buildings a long-term CO_2 storage for the entire lifespan of a house or longer if reused after the building is demolished.

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References: Gravitis J., Abolins J., Dobele G. et al. Composites of steam exploded biomass. Proceedings of Annual Meeting of IAWS and 5th International Symposium on Interaction of Wood with Various Forms of Energy, Arbora Publishers, 2013, 79-84.

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